DOCUMENT RESUME

ED 474 145 HE 035 678

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TITLE	The Use of Biglan Categories in Assessing General Education Courses.
PUB DATE	2002-06-00
NOTE	27p.; Paper presented at the Annual Forum for the Association for Institutional Research (42nd, Toronto, Ontario, Canada, June 2-5, 2002).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC02 Plus Postage.
DESCRIPTORS	*Classification; *College Students; Higher Education; Intellectual Disciplines; *Student Attitudes; Teaching Methods; *Writing Instruction
IDENTIFIERS	Biglan (Anthony); *Biglan Model

ABSTRACT

Despite growing efforts to take a more focused approach to teaching writing across academic disciplines, relatively little is known about how writing-intensive courses impact students' perceptions of writing. This study addressed this question by investigating differences across academic disciplines in student perceptions of writing. Anthony Biglan's (1973a; 1973b) model for classifying academic disciplines served as the conceptual framework guiding this exploratory analysis. The sample consisted of 2,570 undergraduates enrolled in writing-intensive courses in the spring semester 2001 in 40 departments. The cases were randomly split in half so that 50% were used for exploratory analyses, and the remaining were used to validate the results from the exploratory analyses. Results indicate that Biglan's classification scheme can be used to provide some insight into the types of teaching methods most appropriate for teaching writing in particular disciplines. With regard to the "hard/soft" dimension, results indicate that, in general, student in "hard" disciplines (better structured and more replicable content) and the "pure" disciplines (less applied) were more likely to agree strongly that revising improves understanding of the subject matter and having access to the writing of other students improves subject understanding. Students in the "life" disciplines were more likely to agree that revising improves understanding and that the course assignments as a whole improve writing than were students in the "nonlife" disciplines. The study provides support for the "pure/applied" and "life/nonlife" dimensions, but does not support the "hard/soft" dimension, which has consistently received the strongest support in previous investigations. (Contains 5 tables and 18 references.) (SLD)

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The Use of Biglan Categories in Assessing General Education Courses

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Paper Presented at the Association for Institutional Research 42nd Annual Forum. June 5, 2002. Toronto, Canada.

HE035678

The Use of Biglan Categories in Assessing General Education Courses

Abstract

This contributed paper presents research from an assessment of the writing intensive portion of the general education curriculum at a large research university. Despite growing efforts to take a more focused approach to teaching writing across academic disciplines, relatively little is known about how writing intensive courses impact students' perceptions of writing. This paper addresses this question by investigating differences across academic disciplines in student perceptions of writing. Anthony Biglan's (1973a, 1973b) model for classifying academic disciplines serves as the conceptual framework guiding this exploratory analysis.

The Use of Biglan Categories in Assessing General Education Courses

Those who work in higher education are aware of the important role that disciplinary context plays in almost all academic endeavors (Hativa & Marincovich, 1995). Because disciplinary context has a potentially profound impact on the success or failure of academic endeavors it is important to expand our knowledge about disciplinary differences, and to understand how such differences affect student learning. The present study seeks to advance that effort by investigating how various approaches to teaching writing impact students' perceptions of their writing skills and their understanding of the subject matter. Using the Biglan (1973a; 1973b) model as the conceptual framework, this paper explores whether there are systematic differences across academic disciplines in students' perceptions of writing.

In the past several years, institutions of higher education have begun to take a more focused approach to teaching writing across academic disciplines. Despite these increased efforts, relatively little is known about how writing intensive courses affect students, and more specifically, about how students perceive their writing skills are impacted as a result of taking writing intensive courses. Prior research suggests that differences in students' perceptions of writing may result as a function of the particular discipline in which the writing intensive course is taken. For example, research has demonstrated that faculty differ in their instructional goals, teaching methods, and grading practices (Franklin & Theall, 1992). They even differ in the types of examinations they administer in class. For instance, some teachers ask questions involving analysis and synthesis, while others tend to ask questions that require more memorization and application of course material (Braxton & Nordvall, 1988). Murray and Renaud (1995) suggest that these differences are probably one reason why they have found systematic variations in students' ratings of teaching effectiveness.

Such variations in approaches to teaching may also translate into differences in the ways students' perceive the effectiveness with which writing is taught in the classroom. Rather than occurring randomly across academic disciplines, there is reason to believe that these differences occur systematically. For nearly 30 years researchers in higher education have turned to Anthony Biglan's (1973a; 1973b) model as a way to help explain and systematize distinctions among academic disciplines.

Biglan developed his model by asking faculty to make judgments about the similarities and differences between 36 academic disciplines. Using a multidimensional scaling technique (Kruskal, 1964), Biglan found that the 36 different disciplines could be sorted into three dimensions reflecting (1) "hard" and "soft" sciences, (2) "pure" and "applied" orientations, and (3) "life" and "nonlife" subject matter. Biglan concluded that these three dimensions capture the primary characteristics of disciplinary subject matter most relevant to the cognitive style of the discipline.

The hard/soft dimension pertains to the degree of consensus or paradigm development within the field. If a discipline is well structured, tightly defined, and produces highly replicable research, then it is considered a hard discipline. To the extent that a discipline does not meet these criteria, it is considered a soft discipline. The content and methods of soft disciplines are described as being more idiosyncratic, and complexity is regarded as a legitimate aspect of knowledge (Donald, 1995). Biglan found the strongest support (in terms of variance explained) for the hard/soft dimension. Next, Biglan identified the second strongest dimension as the pure/applied dimension. The pure/applied dimension pertains to the degree of concern with theory as opposed to application. The pure fields do not emphasize applications to practical problems, whereas the applied fields focus on such applications. Finally, Biglan identified the

life/nonlife dimension as the third strongest dimension. The life fields are concerned with the study of living systems, while the nonlife fields focus on the study of nonliving systems.

Since Biglan's initial conceptualization of this three-dimensional framework, other investigations have provided additional validation for the model. Existing research demonstrates that the Biglan dimensions are robust for the full spectrum of colleges and universities, and not just for liberal arts colleges like the one in which Biglan validated the model. For example, Smart and Elton (1982) demonstrated support for the model in a study of 301 colleges and universities, and Creswell and Bean (1981) and Stoecker (1993) validated the model using data from a national database of research and doctorate-granting universities.

The Biglan dimensions have also demonstrated the ability to consistently discern systematic differences in academic disciplines on several variables of interest. For example, the model can be used to determine differences between academic departments in regards to their instructional staffing patterns (Muffo & Langston, 1981); their goal orientations (Smart & Elton, 1975); their reward structures (Smart & McLaughlin, 1978); and their research productivity (Creswell & Bean, 1981). The present study extends this research by investigating if the Biglan classification scheme can also be used to distinguish systematic differences among academic disciplines in regards to their students' perceptions of writing.

Method

Sample and Procedures

The sample consisted of 2,570 undergraduates enrolled in writing intensive courses during the spring 2001 semester. The instructors teaching each of the writing intensive courses administered the questionnaire.

Questionnaire

The 29-item questionnaire was developed by a Core Curriculum committee in conjunction with faculty representatives from the writing intensive courses. The questionnaire was designed as part of a wider effort to assess the writing intensive portion of the Core Curriculum. All questions were rated on a 4-point Likert scale ranging from, "1 = Strongly Disagree" to "4 = Strongly Agree." The questionnaire was broken down into three sections. The first section included 12 questions asking students to rate the extent to which the following teaching methods improved their writing skills: (1) *informal writing done in class or outside of class*, (2) *feedback about writing from other students*, (3) *feedback about writing from the instructor*, (4) *providing feedback to other students about their writing*, (5) *revising at least one draft of a writing assignment*, (6) *essay exams*, (7) *short writing assignments (1-3 typed pages)*, (8) *long writing assignments (4 + typed pages)*, (9) *being supplied with instructor's explanations or criteria for grading assignments*, (10) *being supplied with a written set of instructions for writing assignments*, (11) *having access to a sample of how other students did the writing assignment*, and (12) *the writing assignments used in the course as a whole.* The second section asked students to indicate the extent to which these same 12 methods improved their understanding of the subject matter. The final section, questions 25-29, was broader in scope. Students were asked to rate the extent to which, (25) *taking this course improved my understanding of written communication within the subject/discipline*, (26) *taking this course improved my understanding of oral communication within the subject/discipline*, (27) *taking this course helped my understanding of writing processes used by professionals in the discipline*, (28) *I recognize the value of taking a writing intensive course*, and (29) *overall, my perception of the writing in this course was positive.* These questionnaire items served as the independent variables (i.e., the predictors) in the study.

Dependent Variables

The dependent variables of interest were the three dimensions of academic disciplines identified by Biglan. Classification of departments into academic disciplines was guided by Biglan's initial identification of 36 disciplines, as well as by Malaney's (1986) and by Stoecker's (1993) further classification of disciplines. The specification of the 40 departments investigated in this study is provided in Table 1.

Data Analyses

The 2,570 cases were randomly split in half such that 50% of the cases were used for exploratory analyses (i.e., the analysis sample), and the remaining cases (i.e., the holdout sample) were used to validate the results from the exploratory analyses. Because the three Biglan dimensions are dichotomous dependent variables, logistic regression analysis was used for both the exploratory and confirmatory analyses.

For the exploratory analyses, hierarchical logistic regression was used on the analysis sample to determine which questionnaire items provided the best (nonredundant) prediction of category membership. Because there are three Biglan dimensions, three separate hierarchical logistic regression analyses were conducted; that is, one with the hard/soft dimension as the dependent variable, a second with the pure/applied dimension as the dependent variable, and a third with the life/nonlife dimension as the dependent variable. In all three analyses, the 29 questionnaire items were entered into the regression model as blocks of variables. Because we were most interested in determining which teaching methods have the greatest impact on students' writing skills, questions 1 - 12 were the first block of variables entered into the regression equation. Our next greatest interest was in determining which of those approaches to teaching writing actually improved students' understanding of the subject matter. Consequently,

questions 13 - 24 were entered as the second block of variables. Finally, questions 25 - 29 were entered as the third block of variables.

Because the independent variables were treated as categorical variables, they had to be dummy coded. Dummy coding allowed us to determine the effects of the various levels of the independent variables on category membership. In all cases, the "strongly agree" response was used as the reference group to which all other responses were compared. Because this was an exploratory analysis, the variables within each block were entered into the regression model using a forward stepwise selection procedure. An important aspect of using stepwise logistic regression is the choice of an "alpha" level to judge the importance of the variables. Lee and Koval (1997) examined the issue of significance level for forward selection, stepwise logistic regression. The results of their research indicate that the choice of $\alpha = 0.05$ is too stringent, and often excludes important variables from the model. Consequently, Hosmer and Lemeshow (2000) highly recommend choosing an alpha value in the range from 0.15 to .20. We adhered to these recommendations and set $\alpha = 0.15$ as the criteria for which variables were entered into the equation, and $\alpha = 0.20$ as the criteria for which variables were removed from the equation. The log likelihood ratio was the stepwise method used to estimate the regression models. When the log likelihood value is multiplied by -2 (i.e., -2LL) it provides an overall measure of how well the model fits the data. A well-fitting model has a small value for -2LL (the minimum value for -2LL is 0). Model estimation terminated when the log-likelihood value decreased by less than 0.01%.

For the confirmatory analyses, we attempted to validate the results obtained in the exploratory analyses. The variables selected into the regression equations in the exploratory analyses were entered as the independent variables in the holdout sample. If entry of these variables into the regression model produced a significant chi-square, then we could conclude

that our model provided a reasonable fit to the data. These confirmatory analyses were conducted for all three of the Biglan dimensions.

Results

Exploratory Logistic Regression Analyses for the Hard/Soft Dimension

For the first hierarchical logistic regression analysis, the hard/soft dimension was regressed on the three blocks of questionnaire items. The dependent variable was coded 0 if it was a hard discipline, and 1 if it was a soft discipline. Entry of the first block of variables resulted in a model that was significant, χ^2 (9) = 25.21, $p < .05$, and provided correct predictions for 66.0% of the cases. The Nagelkerke R^2 was .078. Entry of the second block of variables had a statistically significant incremental predictive effect, χ^2 (18) = 56.14, $p < .05$, thereby demonstrating that the second block of variables added unique predictive value beyond that contributed by the first block. Moreover, upon entry of the second block of variables the percent of correct predictions increased marginally to 66.7%, while the Nagelkerke R^2 more than doubled explaining nearly 17% of the variance in category membership. Finally, entry of the third block of variables once again significantly improved model fit, χ^2 (24) = 75.33, $p < .05$, indicating that the third block of variables added unique predictive value beyond that provided by the first and second blocks. This final model predicted 67.9% of the responses correctly, and these variables explained 22.1% of the variance in category membership.

Table 2 presents the results for the significant independent variables in the final logistic regression model for the hard/soft dimension. The effect of the individual variable on the dependent variable is represented by the unstandardized regression coefficient (i.e., logit coefficient), the standard error, the Wald statistic, and the odds ratio. The logit coefficient is interpreted as the rate of change in the log odds as *X* changes. Since interpreting log odds is not very intuitive, an interpretation of the logit coefficient that is usually more intuitive (especially

for dummy coded variables) is the odds ratio. The odds ratio for an independent variable is computed by exponentiating its logit coefficient—that is, exp(b). The odds ratio represents the probability of an event occurring divided by the probability of the event not occurring. As such, the odds ratio assesses the increase (or decrease) in the odds of being in the higher category of the dependent variable (classification as a soft dimension in this case) for a unit increase on the scale of the independent variable. If an independent variable increases the odds of being in the higher category of the dependent variable, then the odds ratio will be larger than 1.0. Conversely, if the independent variable decreases the odds of being in the higher category of the dependent variable, then the odds ratio will be smaller than 1.0. The Wald statistic represents the ratio of the unstandardized logit coefficient to its standard error. The Wald statistic corresponds to significance testing of beta coefficients in ordinary least squares regression.

As indicated in Table 2, questions 6, 9, 17, 21, 23, 25, 29 (presented in their order of entry), and their constituent dummy coded variables, offered the greatest discriminating power between hard ("0") and soft ("1") disciplines. Because each question is a categorical variable, the numbers in parentheses beside each question represent the parameter codings for each level of the independent variable. Because responses are provided on a 4-point Likert scale, the "(1)" corresponds to "strongly disagree," the "(2)" corresponds to "disagree," and the "(3)" corresponds to "agree." The "strongly agree" response is designated as the reference group.

For question number 6, since the odds ratios (OR) for V6(1), V6(2), and V6(3) are all less than 1.0, this means that those who strongly disagree, disagree, or agree that "essay exams improved my writing," have greater odds of being in a hard discipline than those who strongly agree with this statement. For question number 9, the odds ratio for V9(3) is 1.54, indicating that those who agree that "being supplied with instructor's explanations or criteria for grading writing assignments improved my writing" have significantly greater odds of being in a soft discipline

than those who strongly agree with this statement. For question number 17, the odds ratios for V17(1), V17(2) and V17(3) are all greater than 1.0 indicating that those who strongly disagree, disagree or agree that "revising at least one draft of a writing assignment improved my understanding of the subject matter" are more likely to be in a soft discipline than those who strongly agree. The odds ratios for V21(1), V21(2), and V21(3) are all less than 1.0. This means that those who strongly disagree, disagree, or agree that "being supplied with instructor's explanations or criteria for grading writing assignments improved my understanding of the subject" are more likely to be in a hard discipline than those who strongly agree. Question 23 also offered significant discriminating power between hard and soft disciplines. The odds ratios for V23(1), V23(2), and V23(3) were all well above 1.0, thereby indicating that those who strongly disagree, disagree or agree that "having access to a sample of how other students did writing improved my understanding of the subject," are more likely to be in a soft discipline than those who strongly agree. The odds ratio for V25(3) is 1.72, meaning that those who agree that "taking this course improved my understanding of written communication within the subject/discipline" have greater odds of being in a soft discipline than those who strongly agree with this statement. Finally, since the odds ratio for V29(1) is greater than one, this indicates that those who strongly disagree that "overall, my perception of writing in this course was positive" are more likely to be taking the course in a soft discipline than those who strongly agree with this statement. Of these, the findings that are most interesting are those where there are significant differences between those who strongly disagree/disagree, and those who strongly agree; that is, questions 6, 17, 21, 23, and 29. In other words, those items that draw distinctions between those who agree and those who strongly agree are less interesting (i.e., questions 9 and 25).

Exploratory Logistic Regression Analyses for the Pure/Applied Dimension

In the second hierarchical logistic regression analysis, the pure/applied dimension was regressed on the three blocks of variables. The dependent variable was coded 0 if it was a pure discipline, and 1 if it was an applied discipline. Entering the first block of variables produced a significant model chi-square value, χ^2 (15) = 49.87, $p < .05$, and provided correct predictions for 63.5% of the cases. The Nagelkerke R^2 for this first model was 0.14. Entering questions 13 - 24 as the second block of variables improved all measures of model fit; however, question 24 was the first variable selected from this block, and it caused the logistic regression model to become unstable and produce inappropriate estimated coefficients and significance levels. Given the iterative nature of the estimation process, it is important to examine the results to see if this type of "overfitting" has occurred and select the prior model as most appropriate (Hair, Anderson, Tatham & Black, 1998). Consequently, we re-estimated the model this time leaving out the second block of variables (i.e., questions 13 - 24). The model fit statistics for the first block of variables (i.e., questions 1 -12) remain unchanged. When questions 25-29 were entered as the next block of variables there was a significant improvement in model fit, χ^2 (18) = 57.67, $p < .05$. This final model predicted 65.5% of the responses correctly, and explained 16.2% of the variance in category membership.

As evidenced in Table 3, questions 2, 3, 5, 11, 12, and 25 offered the greatest discriminatory power between pure ("0") and applied ("1") disciplines. First, the odds ratio for V(2) is less than 1.0, indicating that those who disagree that "feedback from other students improved my writing" are more likely to be in a pure discipline than those who strongly agree. Second, the odds ratio for V3(1) is less than 1.0, meaning that those who strongly disagree that "feedback about writing from the instructor improved my writing" have greater odds of being in a pure discipline than those who strongly agree. Third, because all of the odds ratios for V(5) are greater than 1.0 this means that those who strongly disagree, disagree, or agree that "revising at

least one draft of a writing assignment improved my writing" have significantly greater odds of being in an applied discipline than those who strongly agree. Fourth, for question 11 the odds ratio for V11(3) is less than 1.0, thereby indicating that those who agree that "having access to a sample of how other students did the writing assignment improved my writing" are more likely to be in a pure discipline than those who strongly agree. Fifth, the odds ratio for V12(1) is greater than 1.0 this indicates that those who strongly disagree that "the writing assignments used in the course as a whole improved my writing skills" are more likely to be in an applied discipline than those who strongly agree with this statement. Moreover, because the odds ratio for V12(3) is less than 1.0 this indicates that those who agree have greater odds of being in a pure discipline than those who strongly agree. Finally, the odds ratios for V25(2) and V25(3) are both greater than 1.0 meaning that students who disagree or agree that "taking this course improved my understanding of written communication" have significantly greater odds of being in an applied discipline. Once again, the more interesting results are the ones where significant differences were found among those who strongly disagree/disagree, and those who strongly agree; that is, questions 2, 3, 5, 12, and 25.

Exploratory Logistic Regression Analyses for the Life/Nonlife Dimension

The life/nonlife dimension was regressed on the three blocks of variables. The dependent variable was coded 0 if it was a life discipline, and 1 if it was a nonlife discipline. Entering the first block of variables produced a significant model chi-square value, χ^2 (15) = 32.29, $p < .05$, and provided correct predictions for 63.5% of the cases. This first block of variables captured 10.0% of the variance in category membership. Next, questions 13-24 were entered as the second block of variables. Entry of this second block of variables failed to decrease the log-likelihood value by more than 0.01%. Consequently, none of the variables from the second block were selected for entry into the regression model. This is not surprising given that there were

reasonably high correlations among the first and second block of variables. Entering questions 25-29 as the third block of variables improved all measures of model fit; however, entry of question 27 from the third block caused the logistic regression model to become unstable and produce inappropriate estimated coefficients and significance levels. Due to this overfitting, we selected the prior model that only included the first block of variables as the most appropriate model for interpretation.

Table 4 demonstrates that only questions 5 and 12 provided significant discrimination between life ("0") and nonlife ("1") disciplines. For V5(2) and V5(3) the odds ratios were both greater than 1.0. This indicates that those who disagree or agree that "revising one draft of a writing assignment improved my writing" are more likely to be in nonlife disciplines than those who strongly agree with this statement. For V12(2) the odds ratio is also greater than 1.0 thereby indicating that those who disagree that "the writing assignments used in the course as whole improved my writing" are more likely to be in a nonlife discipline than those who strongly agree with this statement.

Summary of Exploratory Logistic Regression Analyses

Table 5 summarizes the results of the exploratory logistic regression analyses by providing a profile of the academic programs by their related dimensions. This shows how each of the significant independent variables predicts a response of "strongly agree" on one of the Biglan dimensions.

Confirmatory Logistic Regression Analyses

For validation purposes, the variables selected into the regression equations in the exploratory analyses were used as the independent variables in the holdout sample. First, for the hard/soft dimension, questions 6, 9, 17, 21, 23, 25, and 29 were entered into the logistic regression model. Since the purpose of this analysis is confirmatory, we did not use the forward

stepwise selection procedure as done with the exploratory analyses. We were unable to validate the results from the exploratory analyses on the holdout sample for the hard/soft dimension. Entry of these 7 variables produced a non-significant model chi-square value, χ^2 (24) = 26.95, p = .31.

Next, for the pure/applied dimension, the significant independent variables from the exploratory analysis were used to predict category membership on the holdout sample. The pure/applied dimension was regressed on questions 2, 3, 5, 11, 12, and 25. This produced a significant model chi-square value, χ^2 (18) = 63.04, $p < .05$. These variables explained 11.1% of the variance in category membership and correctly classified 63.4% of the cases. Therefore, we concluded that this model provides a good fit for the data.

Finally, for the life/nonlife dimension, questions 5 and 12 were used to predict category membership to either the life or nonlife dimension. Entry of these two variables produced a significant chi-square value, χ^2 (6) = 16.92, $p < .05$, thereby indicating acceptable model fit. This model correctly categorized 63% of the disciplines; however, these two variables only explained 2% of the variance in category membership.

Discussion

The results from the present study indicate that Biglan's classification scheme can be used to provide some insight into which types of teaching methods are most appropriate for teaching writing in particular disciplines. For the hard/soft dimension, the results from the exploratory analyses indicate that, in general, students in hard disciplines were more likely to strongly agree that: (1) revising at least one draft of a writing assignment improved my understanding of the subject matter, and (2) having access to a sample of how other students did the writing assignment improved my understanding of the subject. These findings are consistent with what might be expected; that is, students in the hard disciplines try to do things the "correct" way.

Once they have a better idea as to what the right or correct way is via revision or samples of other students' work, they tend to be more satisfied.

Students enrolled in writing intensive courses in hard disciplines were also more likely to strongly agree that their overall perception of the writing in the course was positive. This finding may seem somewhat counterintuitive. That is, typically soft disciplines are the ones considered to place greater emphasis on writing. One possible explanation for this counterintuitive finding is that the students in hard disciplines may have had less writing experience than students in soft disciplines. Consequently, the writing intensive course may have been of greater benefit to students in hard disciplines. As for the soft disciplines, students enrolled in these writing intensive courses were more likely to strongly agree that: (1) essay exams improved my writing skills, and (2) being supplied with instructor's explanations or criteria for grading writing assignments improved my understanding of the subject matter. The finding that students in soft disciplines were more receptive to essay exams is consistent with the notion that soft disciplines are more receptive to writing than hard disciplines. A caveat is in order regarding the results for the hard/soft dimension. Because we were unable to validate these results on the holdout sample, the results from this exploratory analysis must be interpreted with caution.

The results from the exploratory analyses for the pure/applied dimension indicate that students in pure disciplines were more likely to strongly agree that: (1) revising at least one draft of a writing assignment improved my writing, (2) the writing assignments used in the course as a whole improved my writing skills, and (3) taking this course improved my understanding of written communication within the subject/discipline. In contrast, the students in applied disciplines were only significantly more likely to strongly agree that: (1) feedback from other students improved my writing skills, and (2) feedback about writing from the instructor improved my writing. Overall, these results suggest that students in pure disciplines are more

generally satisfied with traditional teaching methods, while students in applied disciplines were more specifically benefited by the use of feedback. These findings are validated in the holdout sample.

Finally, the results from the life/nonlife dimension indicate that students in life disciplines were more likely to strongly agree that: (1) revising at least one draft of a writing assignment improved my writing, and (2) the writing assignments used in the course as a whole improve writing. Interestingly, there were no teaching methods with which students in nonlife disciplines were significantly more likely than students in life disciplines to strongly agree with. These findings were validated in the holdout sample; however, these two variables explain only a small amount of the variance in category membership. This finding is typical in investigations of the Biglan model where the life/nonlife dimension nearly always presents the most difficulty in terms of explaining variance in category membership (e.g., Smart & McLaughlin, 1978).

Limitations

There are three major limitations of this study. First, in regards to methodology, this study is limited in that the context in which the questionnaire was administered was not controlled. The questionnaire was administered by the instructor teaching the course, as opposed to a trained researcher. This is problematic because some instructors may have allowed students more time to complete the questionnaire than others. Also, some instructors may have begun lecturing while students were still completing the questionnaire, and others may have waited to start class until everyone was finished. Additionally, some instructors may have administered the questionnaire at the beginning of the class period and others at the end of class. Furthermore, some may have administered the questionnaire as soon as they received it, whereas others may have waited until the last day of class. These inconsistencies in administration may have introduced confounds into the data.

The second limitation relates to the statistical analyses performed on the data. Even though this study was exploratory in nature, whenever a large number of predictors (i.e., independent variables) are entered into a model, overfitting becomes a viable threat. This problem was encountered in the analyses for the pure/applied and life/nonlife disciplines. To help deal with the problem of too many predictors, a common data reduction technique is to submit the independent variables to a factor analysis and then use the factor scores as the predictors. Unfortunately, when the data in the present study were factor analyzed questions loaded on one general factor that made little conceptual sense. Furthermore, entering the one general factor score failed to provide any meaningful distinctions among the academic disciplines. Consequently, we decided to enter all the independent variables into the model, while being cautious to interpret only those models where overfitting did not occur.

A third limitation of this study is that the data came from a single institution. Moreover, the applied majors were overly represented in the sample used in this study. It may be that these results would not be replicated at a smaller liberal arts college, and/or at an institution where soft disciplines are more prevalent.

Conclusions and Future Directions

This investigation provides additional support for the validation of Biglan's pure/applied and life/nonlife dimensions. Surprisingly, the hard/soft dimension is not validated in this study. Because the hard/soft dimension has consistently received the strongest support in previous investigations, it may be that there was something atypical about the holdout sample used to validate the hard/soft dimension in this study. When the hard/soft dimension is regressed on the questionnaire items in the analysis sample, it produces the highest classification accuracy and explains the most variance out of all three dimensions. This lends further support to the conclusion that there is something atypical about the sample used to validate the hard/soft

dimension. Consequently, we recommend that this analysis be replicated on a different sample. We also encourage researchers to continue to investigate other sources of variation in students' perceptions of writing. While the variables considered in this study explain a significant amount of variance in students' perceptions of writing, there is still a considerable amount of variance yet to be explained. It may be that there are actually greater differences in teaching methods among faculty members' within the same disciplines than there are across academic disciplines.

This study marks one of the first attempts to gain a better understanding of how the relatively new concept of writing intensive courses impact our students. The results from this analysis help to explain how the effectiveness of particular methods for teaching writing can vary across academic disciplines. This study suggests that just because one particular method for teaching writing works well in one discipline, it does not necessarily mean that the same method will work well in other disciplines. Investigations like the one in this study should help faculty and practitioners of higher education to be flexible in their teaching methods so that they can adapt their methods in ways that best meet the needs of students. Clearly, this is an area in need of further investigation.

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Table 1. Biglan Classifications

	Hard		Soft	
	Life	**Nonlife**	**Life**	**Nonlife**
Pure	Biochemistry (38) Biology (290)	Math (43)	Political Science (30) Psychology (30) Religion (28) Sociology (19)	Communication (167) English (264) History (88) Philosophy (66) Art (98) Music (11) Interdisciplinary St. (31) Geography (9)
Applied	Agriculture Economics (21) Animal & Poultry Sc. (26) Wood Science (13) Environmental Sc. (12) Forestry (16) Fisheries & Wildlife (16)	Civil Engineering (250) Engineering Sc. & Mechanics (12) Industrial Systems Eng. (71) Mechanical Engineering (53) Minerals & Mining Engineering (26) Materials Science Engineering (10) Aerospace & Ocean Engineering (27)	Teaching & Learn. (21) Human Develop. (282) Landscape Arch. (94)	Accounting (27) Finance (67) Tourism Mgmt. (32) Management (48) Marketing (59) Management Sc. (99) Clothing & Textiles (21) Resource Mgmt. (20) Urban Affairs (35)

Table 2

Exploratory Logistic Regression Results for Final Model of Hard/Soft Dimension

Variable	b	S.E.	Wald	Odds Ratio
V6(1)	-1.31	.50	6.87	.27
V6(2)	-1.30	.43	9.26	.27
V6(3)	-1.30	.40	10.66	.27
V9(3)	.43	.29	2.12	1.54
V17(1)	2.84	.92	9.55	17.19
V17(2)	.645	.43	2.26	1.91
V17(3)	.55	.33	2.80	1.74
V21(1)	-1.65	.88	3.50	.19
V21(2)	-1.17	.49	5.71	.31
V21(3)	-1.07	.38	7.74	.34
V23(1)	1.91	.72	7.09	6.78
V23(2)	.99	.51	3.74	2.70
V23(3)	.99	.42	5.53	2.70
V25(3)	.54	.33	2.66	1.72
V29(1)	2.89	1.18	6.05	18.02

Note. Hard = 0 Soft = 1

Table 3

Exploratory Logistic Regression Results for Final Model of Pure/Applied Dimension

Variable	b	S.E.	Wald	Odds Ratio
V2(2)	-.52	.38	1.87	.60
V3(1)	-3.83	1.38	7.75	.02
V5(1)	2.35	.91	6.69	10.52
V5(2)	1.10	.39	7.66	2.97
V5(3)	.47	.26	3.20	1.59
V11(3)	-.54	.32	2.88	.58
V12(1)	1.63	1.18	1.90	5.10
V12(3)	-.51	.30	2.81	.60
V25(2)	1.15	.43	7.32	3.17
V25(3)	.36	.28	1.66	1.43

Note. Pure = 0 Applied = 1

Table 4

Exploratory Logistic Regression Results for Final Model of Life/Nonlife Dimension

Variable	b	S.E.	Wald	Odds Ratio
V5(2)	1.18	.41	8.37	3.26
V5(3)	.36	.24	2.27	1.44
V12(2)	.49	.37	1.77	1.63

Note. Life = 0 Nonlife = 1

Table 5

Summary of Exploratory Logistic Regression Results by Items and Corresponding Dimension

A response of "Strongly Agree" is a significant predictor of:	
Hard/Soft Dimension	
17. Revising at least one draft of a writing assignment improved my understanding of the subject.	HARD
23. Having access to a sample of how other students did writing improved my understanding of the subject.	HARD
29. Overall, my perception of the writing in this course was positive.	HARD
6. Essay exams improved my writing.	SOFT
21. Being supplied with instructor's explanations or criteria for grading writing assignments improved my understanding of the subject.	SOFT
Pure/Applied Dimension	
5. Revising at least one draft of a writing assignment improved my writing.	PURE
12. The writing assignments used in the course as a whole improved my writing.	PURE
25. Taking this course improved my understanding of written communication within the subject/discipline.	PURE
2. Feedback from other students improved my writing.	APPLIED
3. Feedback about writing from the instructor improved my writing.	APPLIED
Life/Nonlife Dimension	
5. Revising at least one draft of a writing assignment improved my writing.	LIFE
12. The writing assignments used in the course as a whole improved my writing.	LIFE

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